Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

EMBRYOLOGY.[1]

Frog Eggs under Pressure.—Professor G. Born[2] describes some interesting experiments made upon cleaving eggs of the frog. The eggs were subjected to pressure by confinement between glass plates that pressed upon the jelly about the egg and flattened out the egg itself so that its diameters were as 2 to 3 or even, in extreme cases, as 1 to 2.

The eggs were put between the plates before fertilization and could thus be arranged carefully with reference to the relative position of the main axis of the egg and the surface of pressure. Glass strips between the glass plates kept these apart a certain distance, say 1·4 mm.

Under these conditions cleavage takes place and the medullary folds may arise and even close over.

If the eggs stand in their normal vertical position—i. e., with the dark side uppermost and the horizontal plates press then thus in a direction parallel to the chief or vertical axis of the egg, the following departures from the normal cleavage take place.

The third cleavage is not, as normally would occur, by a horizontal furrow at right angles to the first and second furrows, but by two vertical furrows on either side of and parallel with the first furrow. The planes of the 1st, 2d and 3d cleavages are thus all at right angles to the pressing plates. This is true also of the 4th cleavage which is accomplished by two planes parallel to the 2d cleavage plane and at right angles to the first.

In such eggs, kept under pressure, the blastopore and subsequently the medullary folds appear upon the under side of the egg; the ventral part of the embryo is upward in these compressed, fixed eggs.

If the eggs are arranged so as to be squeezed from the sides, are compressed between plates parallel to the main axis of the egg, which stands vertically, then the following unusual cleavage phenomena are seen.

The first plane being as usual vertical, is also at right angles to the pressing plates; the second is not vertical as normally would be the case, but horizontal. The third cleavage is often expressed by two planes parallel to the first, while the fourth may be parallel to the second.

---

[1] Edited by Dr. E. A. Andrews, Baltimore, Md.

[2] Anatomischer Anzeiger, VIII, Aug. 5, '93, pps. 609-627.

These departures from the normal might be due to the direct effect of the pressure acting upon the dividing nuclei or else to the secondary effects brought about through the change of form the egg suffers under the pressure.

While Pflüger was inclined to regard the pressure as acting directly, as determining the direction in which the nucleus could most easily elongate, the author thinks that the change of form of the protoplasm is the determining cause of the new arrangement of the cleavage planes. He thinks that these phenomena may be brought under the rule formulated by O. Hertwig, that in dividing the nucleus tends to get into the center of its field of action, the surrounding protoplasmic mass, and places itself so that its poles are toward the largest masses of protoplasm.

It is thus not the pressure which directly alters the position of the nuclear spindle but the forced change of form of the protoplasm of the cell which necessitates an adjusted position of nucleus and hence a subsequent change in the direction of the cleavage.

If the author succeeds in making out in detail this mass effect of these distorted cells we would seem to have additional reason for regarding the nucleus as of less value than the protoplasm in the determination of form.

Embryology of Chiton.—Dr. M. M. Metcalf studied the embryology of *Chiton marmoratus* and *C. squamosus* at Jamaica, where the Marine Laboratory of the Johns Hopkins University was located in 1891. An account of the breeding habits, methods of studying the small opaque eggs (use of hardening liquids, hypochlorite of soda to remove the chorion and yolk, etc.) and a detailed, illustrated description of the cleavage and gastrulation is given in the last number of the Studies of the Biological Laboratory, Baltimore, October, 1893.

The eggs were obtained from specimens kept in aquaria; both eggs and sperm are discharged for a period of two hours or more after a time of active, sexual excitement. The males and females, however, do not approach one another but seem to give off the sexual cells under the stimulus of some unknown influence.

The cleavage is described and figured in great detail chiefly from surface views of living eggs, and from reconstruction of sections up to the forty cell stage. The gastrulation also is given in detail and presents interesting features with reference to the slit like form of the blastopore in Peripatus. Later stages are reserved for subsequent work. In general the results here given confirm the work of Kowalevsky.

Lithium Monsters.—Curt Herbst[3] has continued his work[4] upon the action of salts upon echinoderm larvæ and publishes a full account, with careful figures, of the various abnormal or monstrous larval forms produced by the action of very dilute solutions of lithium chlorid.

Both Sphærechinus and Echinus give results though Asterius, and presumably other animals, act differently or not at all under the influence of this salt.

The eggs are fertilized and then put into sea water containing 2½% of the lithium solution. This solution itself is, however, very weak, only 3·8 g Li Cl to 100 cm hydrant water.

The blastulas that arise from these eggs have thick walls with the inner end of their cells much vacuolated at first, but as they enlarge become elongated vesicles with thin walls. This vesicle becomes constricted into two, more or less separate; one has a thicker wall and long cilia, the other a thinner wall and short cilia. Between the two an intermediate, connecting vesicle may subsequently be interpolated.

Now it is evident that one of the vesicles, the one with thin cells of long cilia represents the ectodermal part and the other vesicle, the thick walled one, the entodermal part of a gastrula turned inside out; for there are all transition stages between these double vesicles and what the author calls exogastrulæ. These are evidently gastrulas in which the entodermal tube protrudes as a closed, thick walled process just as would be formed if the entoderm grew outward instead of inward as normally happens.

Invagination being due to a rapid growth of a zone of cells on the vegetative side of the blastula we need but have the direction of growth changed, by the lithium salt, to produce such an exogastrula. If this zone of growth extend, under the influence of the salt, more and more over the vegetative side of the blastula there will result a more typical lithium larvæ, or stages between it and the exogastrula. Finally some cases arise in which it seems that this zone extends all over the blastula; such larvæ are mere single vesicles of entoderm! There is thus a conversion of what would normally form outside and inside, ectoderm and entoderm, of the gastrula, into what may be styled entoderm only.

The author thus agrees with Driesch in regarding the cells of the early larvæ as omnipotent in their capabilities; they may become ectoderm or entoderm; the idioplasm is not early divided qualitatively amongst the cells as Raux and as Weismann maintain. This same lack of differentiation is shown, the author holds, by certain other abnormalities sometimes produced when the embryos are subject to the action of lithium. Thus larvæ may be reared in which the arms and ciliated band are formed in abnormal places, from cells, apparently, which would not normally form such structures at all, i. e., cells have been induced to form what they would not be able to form were they really specialized.

---

[3] Mitth. Zool. Sta. Neapel. II.

[4] See AMERICAN NATURALIST, March, 1893.

From the wealth of observation upon the action of lithium at different stages of larval life exposed for different periods to this action we can select only one of the interesting facts that result, namely, that the action of this salt does not cease when the egg is removed from the salt into pure sea water. Under some conditions such eggs may continue to develop along the abnormal direction or may begin to form lithium larvæ, though as far as can be seen they are perfectly normal when removed from the salt into the sea water. Such facts militate against the author's former assumption of the direct action of these salts in modifying the osmotic penetrability of the egg protoplasm and show that the action is a more subtle, unknown one.

The author argues that the entoderm cells of the blastula have the property of taking up and holding the lithium salt to a greater extent than do the ectoderm cells. In some unknown way this is connected with their unusual mode of growth.

It is important to note that the eggs of different individuals react to quite different extents, different degrees, to the stimulus produced by the same amount of the lithium salt.

Mechanics of Embryology.—Hans Driesch[5] adds four more chapters to his six previous contributions to this subject.

The first treats of the results obtained when the eggs of Sphærechinus are put, about twenty-six hours after fertilization, into water that is kept for eighteen hours in a warm chamber heated at 30° C.

The larvæ that result are blastulas with a protruding tube on one side; in fact the increased temperature has brought about the same result as Herbst obtained by the use of lithium salt, the gastrulations begin in an inverted sense, the entoderm grows outward instead of inward. Such *exogastrulæ* when removed to cooler water continue to live and may form plutei with long entodermal tubes attached; in each case the entodermal tube, or more properly closed pouch, is divided into three regions as it would be if it grew inside the ectodermal vesicle or body wall.

---

[5] Mitth. Zool. Station Neapel II. 1893.

The entodermal tract remains small—does not swell out as in the lithium larvæ—and ultimately shrinks and falls off.

In this way *anenteria* are formed, or plutei having no entoderm. Yet in these there is formed a small oral invagination without the presence of the entoderm. Such *anenteria* lived a week, but did not regenerate the digestive tract.

The second chapter deals with the effects produced by water containing less than the normal percentage of salts. Eggs of Echinus as soon as fertilized, are put into sea water to which fresh water has been added in the proportion of 45·5; after five minutes they are transferred to 40·10 and then 35·15 and so on to 25·25.

The eggs swell, cleave normally in 45·5 but abnormally in 40·10 and 35·15; while in 30·20 only the nuclei divide; in weaker solutions the eggs die. The abnormal cleavage above mentioned consists in the unequal size of the cells formed in the eight cell stage. Here there are 2 to 4 cells so small that they may be called micromeres. In the weaker solution, 35·15, there is added the shifting of the cells into a tetrahedral arrangement not otherwise present.

Having thus produced apparent micromeres by varying the percentage of salts in the sea water, the author regards the normal micromeres as not essentially different from the macromeres in their nuclei or idioplastic parts, but as merely a result of the activity of the protoplasm; protoplasm may be effected by external agencies so as to make micromeres when they are not predetermined by any character of the nuclei.

The third section takes up his previous conclusions as to the interchangeableness of the ectoderm and entoderm in their beginning. Not satisfied with the facts formerly relied upon to show that what would be ectoderm cells could form entoderm and vice versa, attempts were made to determine the relation between the position of the micromeres and the place of origin of the entodermal invagination. But the experiment failed, since the eggs revolved in the capillary tubes in which they were reared and so made conclusions invalid. A second series of experiments was successful in showing the independence of micromeres and entoderm and also in demonstrating that cells normally destined to form the vegetative side of a blastula could form a complete larvæ, while cells that should have formed the other half of the blastula could also form a complete larvæ.

These experiments consisted in shaking off one or the other sets of cells in the sixteen cell stage, after the egg membrane had been removed. At this stage there are eight equal cells, of the vegetative region, four large cells and four micromeres of the animal region. Complete pleuti arise when the micromeres are absent; when only some of the above 8 negative cells are present.

The facts in connection with the author's previous experiments upon compressed eggs show, he thinks, that the nuclei of a cleaving egg are equivalent and that the germ layers are not separated during cleavage by any qualitative nuclear divisions.

The presence of micromeres is shown to be unnecessary for the formation of an echinus gastrula.

(Some attempts to form fusions of cleaving eggs are mentioned here, though they were not successful; the eggs adhered (after treatment with chloroform) but eventually separated again).

The last chapter deals with some fundamental questions and results reached by this mode of investigation.

The outcome of all the author's work is in opposition to the views held by Roux and Weismann, for it is shown that the cleaving egg, at least in these echinoderms, is not differentiated as regards its nuclei which are all alike in quality. Not so the protoplasm of the eggs which the author maintains must be anisotropic from the first, must possess a differentiation in direction so that all of it, or a part of it when removed, acts like a stimulus in producing the first differentiation of form, which is the first difference between the ends of the main axis of the larvæ. When the larva becomes bilateral this is due to a like direct specialization in the protoplasm, finding its expression in the difference seen between the dorsal and ventral sides of the larvæ.

Some organs may owe their position directly to this determined axial condition, others may arise from more indirect causes, from stimul- that come either from other separate organs or from without the organi ism.

Cells become this or that according to their position; the organs arise as functions of the positions of the cells forming these organs. Thus is the peculiar half-dead embryo Roux obtained in the case of the frog; the cells are forced to remain in their original or normal positions by the presence of the dead half-embryo; if this were away the cells could rearrange themselves and so coming into new positions would form one complete embryo, not a half embryo.

The evolution of form in an individual is the result of stimuli and reactions of a complex interacting nature. These only are investigated in "entwicklungsmechanische studien." The primal origin of form lies in the ovum; the ontogeny is not true epigenesis but rather an evolution, since the protoplasm at the first has a tendency toward direction, is an-isotropic; this initiates the subsequent actions and interactions of parts.

This branch of biological study thus leads back only to something having determined form, not to a physicochemical starting point; the problems of morphology are not physicochemical problems.